



Journal of Life & Physical Sciences

Research

Available online @ www.actasatech.com

actaSATECH 13 (2): 126 – 139 (2021)



Prevalence of overweight and obesity among in-school adolescents in a selected district in Southwest Nigeria

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Abstract

Owing to progressive urbanization, economic growth and the associated lifestyle changes, adolescent overweight is becoming challenging, yet under-recognized problem in many developing countries. This study therefore aimed to determine the prevalence of adolescent overweight and obesity in Ikenne Local Government Area, Ogun State. A cross-sectional school-based study was conducted among 622 in-school adolescents between 10 and 19 years through a multistage sampling technique. The instrument used was a pretested, interviewer-administered questionnaire. Anthropometric measurements including body weight, and height measurements were taken. Data were analyzed using descriptive statistics, chi-square test and binary logistic regression. The mean age of the respondents was 15 ± 2 years. The prevalence of adolescent overweight and obesity was 12.7%. Factors associated with adolescent overweight and obesity included age (AOR: 0.42; 95% CI: 0.26 – 0.67), type of school (AOR: 3.32; 95% CI: 2.04 – 5.41), father's secondary education (AOR: 1.70; 95% CI: 1.04 – 2.79), and mother's secondary education (AOR: 1.81; 95% CI: 1.10 – 2.99). The prevalence of adolescent overweight and obesity is relatively low in Ikenne LGA. There is an urgent need to continuously monitor the current trends in adolescents' growth and development so that early detection and preventive measures are taken to reduce its multi-level complications.

Keywords: Adolescent Overweight and Obesity, Malnutrition, WHO Growth Reference Chart, BMI-for-age.

Introduction

Overweight and obesity are a leading cause of morbidity and mortality worldwide (Sabageh & Ojofeitimi, 2013) and constitute considerable risk for many chronic and non-communicable diseases (Muthuri et al., 2014) such as cardiovascular diseases, hypertension, type 2 diabetes mellitus, psychosocial problems, stroke, arthritis and cancers among others (Steyn & Mchiza, 2014). Overweight and obesity constitute the fifth leading cause of mortality worldwide (World Health Organization, 2021).

Adolescents constitute about 20% of world's population with about 85% living in developing countries. An estimate of about 340 million children and adolescents between ages 5 – 19 years were overweight or obese in 2016 (WHO, 2021). Overweight/obese adolescents are four times as likely to become obese adults as normal-weight adolescents (Sahoo et al., 2015). Childhood obesity is a precursor for a number of health complications in adulthood. Although, obesity-related diseases occur more frequently in adulthood, most of these begin during adolescence. Health-related issues that may accompany childhood obesity include early maturation, hyperlipidemia, glucose intolerance and psychosocial problems such as negative self-image, low self-esteem behavioral and learning difficulties (Sahoo et al., 2015; WHO, 2021).

According to Lobstein et al. (2004), the estimated global prevalence of overweight and obesity in children and adolescents of 5 to 17 years of age was 10%. There has been a steady rise in the prevalence of overweight and obesity among children and adolescents between 5 and 19 years from 4% in 1975 to over 18% in 2016 (WHO, 2021). Adeloye et al. (2021) reported that more than 21 million and 12 million persons were overweight and obese in Nigeria from 15 years of age and

above in 2020 accounting for an age-adjusted prevalence of 20.3% and 11.6%, respectively. Economic changes have been documented to influence the prevalence of adolescent overweight and obesity (Ene-Obong et al., 2012). The aim of this study was therefore to determine the prevalence of overweight and obesity among in-school adolescents in Ikenne Local Government Area, Ogun State.

Methods

A school-based cross sectional study was conducted in Ikenne Local Government Area (LGA) in Ogun State, Southwest Nigeria. Six hundred and twenty-two (622) in-school adolescents between the ages of 10 and 19 years were selected using multistage sampling technique as follows:

Stage 1: Two communities were randomly selected from the five communities in IKLGA

Stage 2: From the selected communities, secondary schools were stratified into public and private schools. Two private and one public secondary school were selected at random by balloting from one community and two public and one private secondary school from the other community for uniformity (a total of 6 schools were selected randomly from the list of all the schools in the communities).

Stage 3: Probability proportional to size sampling was used to select the total number of study participants in each school. This was determined by dividing the total number of students in each school by the total number of students in all the six (6) schools and multiplying by the sample size (N).

Stage 4: Students from all schools were stratified into Junior and Senior sections and selected with a ratio of 1:2 respectively because more junior adolescents were in the senior classes.

Data were collected using a pre-tested, semi-structured and interviewer-administered questionnaire. The questionnaire contained information on respondents' sociodemographic characteristics, dietary habits, physical activity levels, family history of overweight and obesity and body image perception of adolescents. Anthropometric measurements of adolescents i.e. weight, height, waist and hip measurements were taken.

Body weight of the respondents was measured using a standard portable bathroom scale (Camry Mechanical Personal Scale: Model BR9015B) to the nearest 0.1kg. Each respondent was weighed with light clothing and without shoes and the scale was checked for accuracy after every 10th person. The height of the respondents was measured as the vertical distance from the top of the head to the bottom of the feet with an appropriate height meter to the nearest 0.1cm.

Ethical approval for this study was obtained from Babcock University Health Research Ethics Committee (BUHREC). The principals of the selected schools were visited by the researcher to discuss the purpose of the study and to obtain their permission to carry out the study. All measurements were taken during free periods or break periods in order not to disrupt academic activities. Two research assistants (a male and a female) were adequately trained on how to measure the weight and height of the participants. They were also trained on how to distribute the questionnaires and its contents for easy

understanding to ensure that the participants fill them correctly.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics included frequencies, percentages, means and standard deviation. Inferential statistics used included chi-square test and binary logistic regression to determine the factors associated with adolescent overweight and obesity. Statistical significance was determined at the level of the p-value < 0.05. The Body Mass Index (BMI) was calculated in kg/m². BMI-for-age was classified based on WHO Growth Reference Charts (2007) for 5 – 19 years.

Overweight: > +1 SD (equivalent to BMI 25kg/m² at 19 years)

Obesity: > +2 SD (equivalent to BMI 30kg/m² at 19 years)

Results

Sociodemographic characteristics

A total of 622 secondary school students participated in the study. The mean age of the respondents was 14.93 ± 2.045 years. Majority (61.7%) of the respondents were between 15 – 19 years, while more than half (58.7%) were females. Most (82.2%) respondents were Yoruba, and practiced Christianity (77.5%). Three hundred and ninety four (63.3%) were in public schools while 228 (36.7%) were in private schools. About two-thirds of the respondents (68.9%) were in the senior secondary classes (Table 1).

Table 1: Socio-demographic Characteristics of Respondents

| Variables | Frequency (N = 622) | Percent (%) |
|-------------------------------|----------------------------|--------------------|
| Age (years) | | |
| Mean & SD = 14.93 ± 2.045 yrs | | |
| 10-14 | 238 | 38.3 |
| 15-19 | 384 | 61.7 |
| Sex | | |
| Male | 257 | 41.3 |
| Female | 365 | 58.7 |
| Type of school | | |
| Public | 394 | 63.3 |
| Private | 228 | 36.7 |
| Ethnicity | | |
| Yoruba | 511 | 82.2 |
| Igbo | 84 | 13.5 |
| Others | 27 | 4.4 |
| Religion | | |
| Christianity | 482 | 77.5 |
| Islam | 132 | 21.2 |
| Others | 8 | 1.3 |
| Number of siblings | | |
| 1 – 4 | 428 | 69.1 |
| More than 4 | 191 | 30.9 |
| Birth position | | |
| 1 – 4 | 538 | 86.5 |
| More than 4 | 84 | 13.5 |
| Class | | |
| Junior Secondary | 194 | 31.2 |
| Senior Secondary | 428 | 68.9 |

Anthropometric Assessments of Respondents' Weight Status

Anthropometric measurements of the respondents are presented in Table 2 and 3. The mean weight and height of the respondents were 48.92 ± 15.13 kg and 157.01 ± 10.37 cm respectively. The mean BMI was 19.81 ± 6.70 kg/m². The results showed that the prevalence of overweight and obesity were 10.0% and 2.7% respectively. The combined prevalence of overweight and obesity was 12.7%.

Table 2: Anthropometric Assessment for Weight Status of Respondents

| Anthropometric measurements | Frequency (N = 622) | Percent (%) |
|------------------------------------|--------------------------------|--------------------|
| Weight status – BMI | | |
| Overweight | 62 | 10.0 |
| Obesity | 17 | 2.7 |
| Combined overweight/obesity | 79 | 12.7 |

Table 3: Mean and Standard Deviation of Anthropometric Measurements

| Anthropometric Measurements | Mean | Standard Deviation |
|------------------------------------|-------------|---------------------------|
| Weight (kg) | 48.92 | 15.13 |
| Height (cm) | 157.01 | 10.37 |
| BMI (kg/m ²) | 19.81 | 6.70 |

Association between sociodemographic characteristics and prevalence of overweight and obesity among adolescents

Table 4 showed the result of association between socio-demographic characteristics and prevalence of overweight and obesity among adolescents. There was a statistically significant association between adolescent overweight and obesity and age ($\chi^2 = 13.39$, p

< 0.001), type of school ($\chi^2 = 25.08$, $p < 0.001$) and maternal education ($\chi^2 = 6.85$, $p = 0.033$) (Table 4). There was no statistically significant association between overweight/obesity and sex ($\chi^2 = 0.16$, $p = 0.688$), ethnicity ($\chi^2 = 0.00$, $p = 0.975$), religion ($\chi^2 = 0.12$, $p = 0.725$), area father's highest level of education ($\chi^2 = 5.43$, $p = 0.066$), number of siblings ($\chi^2 = 1.97$, $p = 0.161$), birth position ($\chi^2 = 0.014$, $p = 0.907$) and class ($\chi^2 = 3.66$, $p = 0.056$) (Table 4).

Table 4: Association between sociodemographic characteristics and prevalence of overweight and obesity among respondents

| Socio-demographic characteristics | Overweight/Obesity | | χ^2 | p-value |
|-----------------------------------|--------------------|--------------|----------|----------|
| | Yes | No | | |
| Age (years) | | | 13.39 | < 0.001* |
| 10 – 14 | 45 (18.91%) | 193 (81.09%) | | |
| 15 – 19 | 34 (8.85%) | 350 (91.15%) | | |
| Sex | | | 0.16 | 0.688 |
| Male | 31 (12.06%) | 226 (87.94%) | | |
| Female | 48 (13.15%) | 317 (86.85%) | | |
| Type of school | | | 25.08 | <0.001* |
| Public | 30 (7.61%) | 364 (92.38%) | | |
| Private | 49 (21.49%) | 179 (78.51%) | | |
| Ethnicity | | | 0.00 | 0.975 |
| Yoruba | 65 (12.72%) | 446 (87.28%) | | |
| Others | 14 (12.61%) | 97 (83.39%) | | |
| Religion | | | 0.12 | 0.725 |
| Christianity | 60 (12.45%) | 422 (87.55%) | | |
| Non-Christians | 19 (13.57%) | 121 (86.43%) | | |
| Father's education | | | 5.43 | 0.066 |
| Primary & less | 4 (8.33%) | 44 (91.67%) | | |
| Secondary | 33 (10.25%) | 289 (89.75%) | | |
| Tertiary | 40 (16.26%) | 206 (83.74%) | | |
| Mother's education | | | 6.85 | 0.033* |
| Primary & less | 5 (8.06%) | 57 (91.94%) | | |
| Secondary | 34 (10.15%) | 301 (89.85%) | | |
| Tertiary | 37 (16.97%) | 181 (83.03%) | | |
| Number of siblings | | | 1.97 | 0.161 |

| | | | | |
|-----------------------|-------------|--------------|-------|-------|
| 1 – 4 | 60 (14.02%) | 368 (85.98%) | | |
| More than 4 | 19 (9.95%) | 172 (90.05%) | | |
| Birth position | | | 0.014 | 0.907 |
| 1 – 4 | 68 (12.64%) | 470 (87.36%) | | |
| More than 4 | 11 (13.10%) | 73 (86.90%) | | |
| Class | | | 3.66 | 0.056 |
| Junior secondary | 32 (16.49%) | 162 (83.51%) | | |
| Senior secondary | 47 (10.98%) | 381 (89.02%) | | |

Factors associated with adolescent overweight and obesity

Table 5 showed the result of binary logistic regression of factors associated with adolescent overweight and obesity. Factors that were statistically associated with overweight and obesity in adolescents were respondents' age, type of school, father's secondary education, and mother's secondary education. Adolescents between the ages of 10 – 14 years were about 0.4 times less likely to be overweight/obese (AOR: 0.417; 95% CI: 0.258 – 0.672) compared to adolescents between ages 15 – 19 years. Similarly, adolescents who attended public schools were about three times more likely to be overweight/obese (AOR: 3.321; 95% CI: 2.038 – 5.413) compared to those who attended private schools. Adolescents whose parents (father and mother) had secondary education were about two times more likely to

be overweight/obese in relation to those who had tertiary education (AOR: 1.701; 95% CI: 1.037 – 2.788 and AOR: 1.810; 95% CI: 1.097 – 2.986 respectively).

Results further showed that male adolescents were about 1.1 times more likely than females to be overweight/obese (AOR: 1.104; 95% CI: 0.681 – 1.789); those who lived in rural areas had a 4 times odds of being overweight/obese (AOR: 4.048; 95% CI: 0.850 – 19.278) while those who lived in semi-urban areas were about 2.5 times more likely to be overweight/obese in relation to those who lived in urban areas (AOR: 2.490; 95% CI: 0.870 – 7.122). Adolescents in junior secondary classes were about 0.6 times less likely to be overweight/obese compared to the senior secondary school counterparts (AOR: 0.625; 95% CI: 0.384 – 1.015). However, these factors were not statistically significant.

Table 5: Binary Logistic Regression of Factors associated with Adolescent Overweight and Obesity

| | 95% CI for AOR | | | p-value |
|---------------------------|----------------|-------|--------|---------|
| | AOR | Lower | Upper | |
| Age group | | | | |
| <i>10 – 14</i> | 0.417 | 0.258 | 0.672 | <0.001* |
| <i>15 – 19 (ref)</i> | - | - | - | - |
| Sex | | | | |
| <i>Male</i> | 1.104 | 0.681 | 1.789 | 0.688 |
| <i>Female (ref)</i> | - | - | - | - |
| Type of school | | | | |
| <i>Public</i> | 3.321 | 2.038 | 5.413 | <0.001* |
| <i>Private (ref)</i> | - | - | - | - |
| Area of residence | | | | |
| <i>Rural</i> | 4.048 | 0.850 | 19.278 | 0.079 |
| <i>Semi-urban</i> | 2.490 | 0.870 | 7.122 | 0.089 |
| <i>Urban (ref)</i> | - | - | - | - |
| Ethnicity | | | | |
| <i>Others</i> | 1.010 | 0.544 | 1.873 | 0.975 |
| <i>Yoruba (ref)</i> | - | - | - | - |
| Religion | | | | |
| <i>Non-Christians</i> | 0.905 | 0.520 | 1.576 | 0.725 |
| <i>Christians (ref)</i> | - | - | - | - |
| Father's education | | | | |
| <i>Primary & less</i> | 2.136 | 0.727 | 6.278 | 0.168 |
| <i>Secondary</i> | 1.701 | 1.037 | 2.788 | 0.035* |
| <i>Tertiary (ref)</i> | - | - | - | - |
| Mother's education | | | | |
| <i>Primary & less</i> | 2.330 | 0.874 | 6.210 | 0.091 |

| | | | | |
|---------------------------|-------|-------|-------|--------|
| <i>Secondary</i> | 1.810 | 1.097 | 2.986 | 0.020* |
| <i>Tertiary (ref)</i> | - | - | - | - |
| Number of siblings | | | | |
| <i>1 – 4</i> | 0.678 | 0.392 | 1.171 | 0.163 |
| <i>More than 4 (ref)</i> | - | - | - | - |
| Birth position | | | | |
| <i>1 – 4</i> | 1.041 | 0.526 | 2.062 | 0.907 |
| <i>More than 4 (ref)</i> | - | - | - | - |
| Class category | | | | |
| <i>Junior</i> | 0.625 | 0.384 | 1.015 | 0.057 |
| <i>Senior (ref)</i> | - | - | - | - |

*Statistically significant at $p < 0.05$

Discussion

This study revealed that the prevalence of overweight and obesity were 10% and 2.7% respectively. Adolescent obesity and overweight was associated with age group (10 – 14 years), private school and tertiary maternal education.

The prevalence found in this study was higher than that reported by Mustapha and Sanusi, (2013) among in-school adolescents in Ondo State. Furthermore, several studies have reported prevalence of overweight and obesity in various regions in Nigeria among adolescents. Prevalence rates of combined overweight and obesity reported in Osun State among adolescents using the International Obesity Task Force (IOTF) BMI cut-off values and 2000 CDC age and sex-specific cut-off points (Adeomi *et al.*, 2015), Ile-Ife (Sabageh & Ojofeitimi, 2013), Sagamu, (Akinpelu *et al.*, 2008), Benue (Musa *et al.*, 2012), Port-Harcourt (Adesina *et al.*, 2012), Benin-city (Omuemu & Omuemu, 2010), Ekpoma, Edo State (Abah *et al.*, 2012) and

Sokoto (Ahmad *et al.*, 2013) were less than 10%.

However, studies conducted by Ene-Obong *et al.* (2012) among school-aged children and adolescents in urban Southern Nigeria revealed that the prevalence of overweight (11.4%) and obesity (2.8%) was similar to what we found in this study. Other studies also revealed a higher prevalence of overweight and obesity than those obtained from this study (Oduwole *et al.*, 2012; Chinedu *et al.*, 2012; Owa & Adejuyigbe, 1997).

It was observed that the estimated prevalence of combined overweight and obesity in this study (12.7%) was higher than the prevalence reported by Cole *et al.* (2000) and IOTF (2003) in Africa which was less than 5%. In contrast, studies in South Africa, Ghana, and Botswana showed a higher prevalence of overweight and obesity to be more than 15% (Reddy *et al.*, 2008; Kimani-Murage *et al.*, 2010; Monyeki *et al.*, 2015; Mogre *et al.*, 2013; Maletete *et al.*, 2013).

Estimates of the prevalence of overweight and obesity in this study was found to be higher than the global prevalence of 10% as reported by Lobstein et al. (2004). Several studies in developed countries reveal a higher prevalence of overweight and obesity among adolescents. For example, in the USA (Ogden et al., 2012), Nepal (Archaya et al., 2014), Brazil (Niehues et al., 2014) and Kuwait (Alrashidi et al., 2015), estimates of prevalence of combined overweight and obesity among adolescents were found to be between 15% and 62%. A plausible explanation for these variations in prevalence across the globe is the rural-urban differences i.e. some studies were conducted in urban areas where it is generally assumed that urban children have a better high-energy diet or refined diet than their rural counterparts (Oninla et al., 2007).

Bivariate analysis of factors associated with adolescent overweight and obesity revealed that the prevalence of overweight and obesity was significantly associated with adolescents' age, type of school attended and maternal education. The prevalence of overweight and obesity was higher among adolescents who were between the ages of 10 and 14 years (early adolescence) than those who were between 15 and 19 years (late adolescence). A sharp decline in the prevalence of overweight was observed from age 17 years and obesity was completely absent from age 18 years. This is supported by findings from Chinedu et al. (2012). A probable explanation for this finding may be due to the fact that adolescence is a transition period from childhood into adulthood with older adolescents becoming more conscious of their body weight and body shape, since there is development of secondary sexual characteristics and behavioral patterns, which include eating patterns and self-care. At this time, personal preferences take precedence over eating habits learned at home as children

progressively take control over what they eat and where and how they eat.

However, Ene-Obong et al., (2012) reported a rising prevalence at the age of 18 years. This was because a small number of subjects were categorized under this age (i.e. 18 years). It is assumed that most adolescents between 16 and 18 years have graduated from secondary school.

Results further showed that the prevalence of both overweight and obesity showed a trend to be higher among females compared to males, although, this was not statistically significant. A higher prevalence of both overweight and obesity in female adolescents compared to male adolescents have also been observed from studies conducted in Nigeria (Ene-Obong et al., 2012; Ahmad et al., 2013; Musa et al., 2012). It is however largely unclear what the reason for this association could be but a plausible explanation for these findings may be as a result of the physical activity levels in relation to energy expenditure during and after school hours and cultural reasons. Playgrounds in schools studied were mainly dominated by the male adolescents while the females tend to be more inactive during their break periods.

Increased rates of overweight and obesity were observed among adolescents who attended private schools in comparison with those who attended public schools. This finding corroborates with a study conducted among private and public school adolescents in Ekpoma, Edo State (Abah et al., 2012). This may be as a result of differences in socioeconomic status between private and public school students. The private schools pay tuition fees while the public schools do not pay tuition thus, one may infer that adolescents from higher socioeconomic status homes may patronize private schools more than public schools. It is also assumed that

private school adolescents have access to adequate diet and more junks.

Maternal level of education was significantly associated with overweight and obesity among adolescents. Those whose mothers had tertiary education were more likely to be overweight/obese compared to those whose mothers had a secondary or primary education and they were more likely to attend private schools. This supports that children from higher socioeconomic status homes may be more likely to be obese/overweight. This finding corroborates with a study conducted by Piryani *et al.* (2016) in Nepal. However, a study conducted by Mustapha and Sanusi (2013) reported a contrary observation among adolescents' maternal level of education in Ondo State, Nigeria. Majority of mothers who had tertiary education were professionals and into business. Reasons for these findings may be due to lack of time with children to prepare healthy meals and provision of junk foods because of the nature of the mothers' occupation.

Other variables such as ethnicity, religion, number of siblings, birth position and class category were not significantly associated with the prevalence of overweight and obesity in this study. In contrast, previous findings reported a significant relationship between ethnicity (Acharya *et al.*, 2014; Piryani *et al.*, 2016), religion (Morgre *et al.*, 2013), number of siblings and birth position (Ojofeitimi *et al.*, 2011; Acharya *et al.*, 2014; Piryani *et al.*, 2016) and weight status among adolescents.

Conclusion

The prevalence of overweight and obesity among adolescents as evident from this study indicates that childhood malnutrition is still a major public health problem in Nigeria. The double burden of malnutrition (underweight and overweight/obesity) in Nigeria requires an urgent need to continuously monitor the

current trends in adolescents' growth and development so that early detection and preventive measures are taken to reduce obesity-associated morbidities.

Acknowledgements

This study has no funding sponsors. However, we like to appreciate our colleagues in the Department of Public Health, Babcock University and Department of Epidemiology and Medical Statistics, University of Ibadan for their support and useful suggestions.

Conflict of Interest

The authors hereby declare that no conflicting interests exist.

References

- Abah, S. O., Aigbiremolen, A. O., Duru, C.B., Awunor, N.S., Asogun, A.D., Enahoro, F.O., Akpede, M.E. 2012. Prevalence of overweight and obesity among students in private and public secondary schools in a peri-urban Nigerian town. *Journal of Biology, Agriculture and Healthcare*, 2(11): 51-57.
- Acharya, B., Chauhan, H.S., Thapa, S.B., Kaphle, H.P., Malla, D. 2014. Prevalence and socio-demographic factors associated with overweight and obesity among adolescents in Kaski district, Nepal. *Indian Journal of Community Health*, 26(2):118-122
- Adeloye, D., Ige-Elegbede, J.O., Ezejimofor, M., Owolabi, E.O., Ezeigwe, N., Omoyele, C., Mpazanje, R.G., Dewan, M.T., Agogo, E., Gadanya, M.A., Alemu, W., Harhay, M.O., Auta, A., Adebisi, A.O. 2021. Estimating the prevalence of overweight and obesity in Nigeria in 2020: a systematic review

- and meta-analysis. *Annals of Medicine*, 53(1): 495- 507
- Adeomi, A.A., Adeoye, O.A., Bamidele, J.O., Abodunrin, O.L., Odu, O.O., Adeomi, O.A. 2015. Pattern and determinants of the weight status of school-age children from rural and urban communities of Osun state, Nigeria: A comparative study. *Journal of Medical Nutrition and Nutraceuticals*, 4(2): 107 – 114
- Adesina, A.F., Peterside, O., Anochie, I., Akani, N.A. 2012. Weight status of adolescents in secondary schools in Port Harcourt using Body Mass Index (BMI). *Italian Journal of Pediatrics*, 38: 31.
- Ahmad, M.M., Ahmed, H., Airede, K. 2013. Body mass index among school adolescents in Sokoto, North-Western Nigeria. *Sahel Medical Journal*, 16: 5-9.
- Akinpelu, A.O., Oyewole, O.O., Oritogun, K.S. 2008. Overweight and obesity: Does it occur in Nigerian adolescents in an urban community? *International Journal of Biomedical Health Services*, 4: 11-17.
- Alrashidi, M., Shahwan-Akl, L., James, J., Jones, L.K. 2015. Contributing Factors to Childhood Overweight and Obesity in Kuwait. *International Journal of Health Sciences*, 3(1): 133-155
- Chinedu, S.N., Eboji, O.K., Emiloju, O.C. 2012. Trends in Weight Abnormality of School Children and Adolescents in Nigeria. *Journal of Medical Sciences*, 12(7): 239-243.
- Cole, T.J., Bellizzi, M.C., Flegal, K.M., Dietz, W.H. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*, 320: 1240–1243
- Ene-Obong, H., Ibeanu, V., Onuoha, N., Ejekwu, A. 2012. Prevalence of overweight, obesity, and thinness among urban school-aged children and adolescents in southern Nigeria. *Food Nutrition Bulletin*, 33: 242–250
- International Obesity Task Force (IOTF). 2003. Data collated for the Global Burden of Disease Project based on published and unpublished sources. Available at: <http://www.iaso.org/iotf/>. Accessed 12 August 2012
- Kimani-Murage, E.W., Kahn, K., Pettifor, J.M., Tollman, S.M., Dunger, D.B., Gómez-Olivé, X.F., Norris, S.A. 2010. The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children. *BMC Public Health*, 10:158, <http://www.biomedcentral.com/1471-2458/10/158>
- Lobstein, T., Baur, L., Uauy, R., IASO International Obesity Task Force. 2004. Obesity in children and young people: a crisis in public health. *Obesity Review*, 5(1):4–104
- Malete, L., Motlhoiwa, K., Shaibu, S., Wrotniak, B.H., Maruapula, S.D., Jackson, J., Compher, C.W. 2013. Body image dissatisfaction is increased in male and overweight/obese adolescents in Botswana. *Journal of Obesity*
- Monyeki, M.A., Awotidebe, A., Strydom, G.L., Hans de Ridder, J., Mamabolo, R.L., Kemper, C.G. 2015. The Challenges of Underweight and

- Overweight in South African Children: Are We Winning or Losing the Battle? A Systematic Review. *International Journal of Environmental Research and Public Health*, 12: 1156-1173; doi:10.3390/ijerph120201156
- Morgre, V., Gaa, P.K., Abukari, R.N. 2013. Overweight, Obesity And Thinness And Associated Factors Among School-Aged Children (5-14 Years) In Tamale, Northern Ghana. *European Scientific Journal*, 9(20)
- Musa, D.I., Toriola, A.L., Monyeke, M.A., Lawal, B. 2012. Prevalence of childhood and adolescent overweight and obesity in Benue State, Nigeria. *Tropical Medical International Health*, 17(11):1369–1375.
- Mustapha, R.A., Sanusi, R.A. 2013. Overweight and Obesity among In-school Adolescents in Ondo State, Southwest Nigeria. *African Journal Biomedical Research*, 16: 205 – 210
- Muthuri, S.K., Francis, C.E., Wachira, L.J., LeBlanc, A.G., Sampson, M. 2014. Evidence of an Overweight/Obesity Transition among School-Aged Children and Youth in Sub-Saharan Africa: A Systematic Review. *PLoS ONE*, 9(3): e92846. doi:10.1371/journal.pone.0092846
- Niehues, J.R., Gonzales, A.I., Lemos, R.R., Bezerra, P.P., Haas P. (2014). Prevalence of Overweight and Obesity in Children and Adolescents from the Age Range of 2 to 19 Years Old in Brazil. *International Journal of Pediatrics*.
- Oduwole, A.A., Ladapo, T.A., Fajolu, I.B., Ekure, E.N., Adeniyi, O.F. 2012. Obesity and elevated blood pressure among adolescents in Lagos, Nigeria: a cross-sectional study. *BMC Public Health*, 12: 616.
- Ogden, C.L., Carroll, M.D., Kit, B.K., Flegal, K.M. 2012. Prevalence of Obesity and Trends in Body Mass Index among US Children and Adolescents, 1999-2010. *JAMA*, 307(5):483-490
- Ojofeitimi, E.O., Olugbenga-Bello, A.I., Adekanle, D.A., Adeomi, A.A. 2011. Pattern and determinants of obesity among adolescent females in private and public schools in the Olorunda Local Government Area of Osun State, Nigeria: a comparative study. *Journal of Public Health in Africa*, 2: e11
- Omuemu, V.O., Omuemu, C.E. 2010. The prevalence of overweight and its risk factors among adolescents in an urban city in Edo State. *Nigerian Journal of Clinical Practice*, 13(2), 128-133
- Oninla, S.O., Owa, J.A., Onayade, A.A., Taiwo, O. 2007. Comparative Study of Nutritional Status of Urban and Rural Nigerian School Children. *Journal of Tropical Pediatrics*, 53(1): 39-43
- Owa, J.A., Adejuyigbe, O. 1997. Fat mass, fat mass percentage, body mass index, mid upper arm circumference in a healthy population of Nigerian children. *Journal of Tropical Pediatrics*, 43: 13–19
- Piryani, S., Baral, K.P., Pradhan, B., Poudyal, A.K., Piryani, R.M. 2016. Overweight and its associated risk factors among urban school adolescents in Nepal: a cross-sectional study. *BMJ Open*, 6:e010335. doi:10.1136/bmjopen-2015-010335
- Reddy, S., Resnicow, K., James, S., Kambaran, N., Omardien, R., Mbewu, A. 2008. Underweight, overweight and obesity among South African adolescents: results of the

- 2002 National Youth Risk Behavior Survey. *Public Health Nutrition*, 1-5
- Sabageh, A.O., Ojofeitimi, E.O. 2013. Prevalence of obesity among adolescents in Ile-Ife, Osun state, Nigeria using body mass index and waist hip ratio: A comparative study. *Nigeria Medical Journal*, 54(3): 153–156.
- Sahoo, K., Sahoo, B., Choudhury, A.K., Sofi, N.Y., Kumar, R., Bhadoria, A.S. 2015. Childhood obesity: causes and consequences. *Journal of Family Medicine and Primary Care*, 4(2): 187-192.
- Steyn, N.P., Mchiza, Z.J. 2014. Obesity and the nutrition transition in Sub-Saharan Africa. *Annals of New York Academy of Sciences*, 13(11): 88–101
- World Health Organization. 2007. *Growth Reference Data for 5 – 19 years*.
- World Health Organization. 2021. *Fact sheets about Obesity and Overweight*. WHO, Geneva.
<https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>